

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow. Claims 1-12 have been rejected. Claim 1 has been amended. No new matter has been added. Accordingly, Claims 1-12 will remain pending in the present application upon entry of this Reply and Amendment.

A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

Claim Rejections – 35 U.S.C. § 112

On page 2 of the Office Action, Claims 1-12 were rejected under 35 U.S.C. § 112 ¶ 2 as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner stated:

The expression “labyrinth-like outlet channels” in lines 5-6 of claim 1 is unclear because it is not known what is encompassed by such language.

In line 7 of claim 1, “the lower part is cut through in the area of the upper part” is incorrect. It is not understood how the lower part can be cut through the area of the upper part in the claimed battery. The lower part is distinguished from the upper part. Clarification is required.

Claims 2-12, dependent on claim 1, fall therewith.

Claim 1 has been amended to clarify the language used therein. Specifically, Claim 1 now recites, “a cover which closes the housing, the cover comprising a lower part which is coupled to the housing, an upper part which is arranged at a distance from the lower part and closes the lower part forming a seal, and outlet channels provided between the lower part and the upper part for acid deposition and forming a labyrinth; wherein the lower part comprises through cut openings adjacent to the outlet channels . . .”

The Applicants submit that one of ordinary skill in the art reviewing the present application would understand what is meant by the word labyrinth, and that accordingly, Claim 1 is not indefinite in this regard.

The applicants also submit that the use of “through cut openings” would be understood by those of ordinary skill in the art reviewing the present application. For example, Figure 1 and paragraphs [0013]-[0014] and [0025] include a description of such an arrangement.

Accordingly, it is submitted that the rejections under 35 U.S.C. § 112 have been overcome.

Claim Rejections – 35 U.S.C. § 102

On page 2 of the Office Action, the Examiner rejected Claims 1-12 under 35 U.S.C. § 102(b) as being anticipated by EP 523273 (“Bernardi et al.”).

The Examiner stated:

Reference is made to page 1 of the present application for the disclosure of the ‘273 patent along with all of the drawing figures in ‘273. As noted, the battery in ‘273 includes a cover with an upper part and a lower part where there are a plurality of mazes with cavities for acid deposition. The cover includes channel walls, ribs and webs between the upper part and the lower part and the battery includes a degassing system as claimed. Figure 6 of -273 depicts the inclined outlet channels.

For the Examiner’s reference, a complete translation of Bernardi et al. has been provided herewith.

Bernardi et al. relates to a “lead accumulator” that includes a “cover” that includes an “upper portion” and a “lower portion.” As described at page 3, lines 24 ff of the translation of Bernardi et al. provided herewith, after “mounting the top plate on the base cover,” a “separate leak test of the whole gas release region in the cover can then be performed.”

Claim 1 is in independent form and recites a “rechargeable battery” comprising, in combination with other elements, “cover comprising a lower part which is coupled to the

housing, an upper part which is arranged at a distance from the lower part” in which “the lower part comprises through cut openings adjacent to the outlet channels.” Claims 2-12 depend from independent Claim 1.

Bernardi et al. does not identically disclose a “rechargeable battery” comprising, among other elements, a “cover comprising a lower part which is coupled to the housing, an upper part which is arranged at a distance from the lower part” in which “the lower part comprises through cut openings adjacent to the outlet channels” as recited in independent Claim 1. For example, as described above, a “leak test” is performed in Bernardi et al.; as recited in Claim 1, however, the battery includes “through cut openings” which would make the performance of such a leak test impossible.

The rejection of Claim 1 over Bernardi et al. is improper, since Bernardi et al. does not disclose at least one element of Claim 1. Claim 1 is patentable over Bernardi et al.

Dependent Claims 2-12, which depend from independent Claim 1, are also patentable. See 35 U.S.C. § 112 ¶ 4.

The Applicants respectfully request withdrawal of the rejection of Claims 1-12 under 35 U.S.C. § 102(b).

* * *

It is submitted that each outstanding objection and rejection to the Application has been overcome, and that the Application is in a condition for allowance. The Applicants request consideration and allowance of all pending Claims 1-12.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

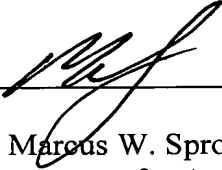
The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or

even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

Respectfully submitted,

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The invention concerns an accumulator, in particular a lead accumulator, preferably for commercial motor vehicles, with a housing comprising several cells as well as with a cover which closes off the housing and in which a labyrinthine cavity for acid precipitation is formed between a lower portion and an upper portion spaced apart therefrom, wherein the lower portion of the cover in the form of a base cover comprises a trough-like recess on top of which the upper portion of the cover is placed and connected thereto, wherein the cover is further provided with a gas release opening comprising ignition prevention means and comprises filling and inspection openings for the cells which can in each case be sealed if occasion arises.

A lead accumulator of this kind is known from DE-U-8 430 246. It consists of a plastic housing in which are arranged several cells, wherein usually six cells are provided. The housing with the cells is closed off by a cover which is placed on top of the housing. The cover in this case consists of a base cover and a top portion spaced apart therefrom, between which is formed a cavity for acid precipitation. In order to conduct away the gases arising during operation of the lead accumulator, the cover is further provided with a gas release opening which comprises ignition prevention means in the form of a flame screen valve. Finally the known lead accumulator for each of the cells comprises in each case a filling and inspection opening which can be sealed by means of a corresponding sealing plug.

The known lead accumulator with a gas release opening integrated in the cover as well as with protection against ignition from the outside is disadvantageously very tall. As a result the space requirements for the lead accumulator are relatively high, so that the possibilities of use are limited. Particularly in the field of commercial vehicles the tall construction makes itself felt particularly adversely.

In US-A-4 851 305 is disclosed a multi-cell

accumulator, wherein the cells are arranged in a housing. This housing is closed off on the upper side by a cover, wherein a labyrinthine cavity for acid precipitation is formed between a lower portion and an upper portion spaced apart therefrom. To obtain a flat cover for a low overall height of the accumulator, the lower portion thereof in the form of a base cover comprises a trough-like recess. This trough-like recess is closed off on the upper side by the upper portion of the cover in the form of a top plate essentially flush with the upper side of the base cover.

A generic accumulator is known from EP-A-0 107 469 which discloses a multi-cell accumulator, wherein the cells are arranged in a housing. This housing is closed off on the upper side by a cover, wherein a labyrinthine cavity for acid precipitation is formed between a lower portion and an upper portion spaced apart therefrom. The upper portion comprises an edge extending in a vertical direction. To obtain a flat cover for a low overall height of the accumulator, the lower portion thereof in the form of a base cover comprises a trough-like recess. This trough-like recess is closed off on the upper side by the upper portion of the cover. In this case the edge of the upper portion in extension of the outer walls of the housing is placed on top of the base cover.

A cover construction of the accumulator of this kind admittedly has a relatively low overall height, but in the field of commercial vehicles there is a need to reduce the overall height still further, as a high design makes itself felt particularly adversely there.

It is the object of the invention further to develop the known accumulator, in particular lead accumulator, preferably for commercial motor vehicles, in such a way that the cover thereof is even lower.

As a technical solution, with the invention it is proposed that the upper portion of the cover in the form of a top plate is placed on top essentially flush with the upper side of the base cover so as to form a closure and

that the depth of the trough-like recess is greater than the height of an edge of the base cover which extends around the lower side and by means of which the base cover is mounted on the housing.

By the fact that according to the invention the cavity formed in the cover is partially sunk in the housing of the accumulator, further optimisation of the flat design of the cover is obtained. The cover for a lead accumulator constructed in this way is thus distinguished by an extremely low overall height, so that the space requirements of the lead accumulator in a vertical direction are reduced to a minimum. This makes it particularly capable of use and suitable in the commercial motor vehicle sector. Furthermore the accumulator constructed in this way with its flat cover is stackable.

The trough-like recess of the base cover of the cover in this case essentially defines the cavity and receives essentially all the components which are necessary for acid precipitation. Mounting of the top plate on the base cover can take place in this case by welding, in particular heated tool welding or in another way. The base cover comprises in this case for each individual cell an opening for filling or gas release and also as a return for the acid. To assemble the battery, first the cover is made by mounting the top plate on the base cover in the manner described above. By means of the cover made in this way, a separate leak test of the whole gas release region in the cover can then be performed first. If this has proceeded successfully, the whole cover is then mounted on the housing of the accumulator, whereupon again a leak test of the individual cells can be performed. The accumulator constructed in this way with its flat cover is stackable as well as overflow-resistant. Subsequent filling of the accumulator with electrolyte is possible without problems. Due to the fact that the depth of the trough-like recess is greater than the height of an edge of the base cover which extends around the lower side and by means of which the

base cover is mounted on the housing, the cavity formed in the cover is thus partially sunk in the housing of the accumulator, which results in further optimisation of the flat design of the cover.

In an advantageous development it is proposed that in the trough-like recess as well as on the lower side of the top plate are integrally formed ribs which mate with each other and which on the one hand define the labyrinth and on the other hand form a mutual support for stabilising the cover. As a result, in a technically extremely simple manner a very efficient cover can be provided, which ensures on the one hand optimum acid precipitation and on the other hand optimum stability. The ribs of the labyrinth in this case form furthermore a restraint for the acid which is in the cells when the accumulator is tilted.

A further development of the invention proposes that the terminal bushes of the accumulator are located in a region of the cover which is not covered by the top plate. This results in a flat surface in the region of the top plate of the cover, so that for example corresponding fixing elements can be arranged thereon without the terminals having a disturbing effect. Furthermore a very good stacking capacity can be produced as a result too.

A further preferred development proposes that in the regions of the individual cells the bottom of the trough-like recess is in each case funnel-shaped in the whole cell region towards a cell opening for filling or gas release and also as a return for the acid. All run-off surfaces of the respective cell thus have a gradient of which the lowermost point is the cell opening, so that the condensed acid accumulating in the cavity can be returned without problems to the respective cell.

In a further development it is proposed that on the lower side of the base cover are integrally formed support members which rest on the plate assembly of the respective cell and support it. As a result, reliable fixing of the plate assemblies within the cells is obtained, so that

trouble-free operation is possible, particularly under high mechanical stresses.

In a further preferred development it is proposed that the cells are arranged in several, preferably two rows which are separated from each other by a partition arranged therebetween and at the end of which is arranged in each case a gas release opening with ignition prevention means. Gas release takes place from one cell to the next, wherein the gas release opening arranged at the end of each row defines a central gas release means. On account of the long distance to the gas release opening, a great deal of the acid can be reprecipitated and returned.

A development of this proposes that the plate assemblies are arranged one behind the other in the cells of the respective row. This means that the plates which form the plate assemblies are oriented parallel to the longitudinal side wall of the housing, and that therefore the plates of the plate assemblies extend in the longitudinal direction of the row.

The ignition prevention means preferably comprises a preliminary chamber as well as a subsequent chamber. This ensures optimum passage of the acid gases through the ignition prevention means, wherein from the subsequent chamber the gases are conducted out of the accumulator.

In a development of the ignition prevention means it is proposed that adjoining the latter in the base cover of the cover is formed a gas release channel. Escape of the gases from the accumulator thus takes place through this gas release channel.

So that the gases do not escape from the accumulator uncontrolled, a gas release hose can preferably be connected to the gas release channel for disposal of the gas.

In a development of the gas release channel it is proposed that the latter is inclined. A further development of the gas release channel proposes that the latter in relation to the longitudinal extent of the row

extends obliquely towards the side wall of the housing. Finally the gas release channels associated with the rows preferably communicate with each other, so that equalisation is produced as a result.

Finally in a development it is proposed that the ignition prevention means is an obliquely arranged flame screen. This has the advantage that in case of possible dehydration of the flame screen the isolated particles flow onto the bottom of the flame screen chamber, from which return to the cells is possible.

By this means gas release from the accumulator is further ensured and clogging of the pore openings of the flame screen is prevented. The flame screens are arranged redundantly.

The advantageous developments of the invention described above on their own constitute all in all independent inventions, without these developments being automatically tied to the flat design of the cover.

A practical example of a lead accumulator according to the invention with an integrated gas release system as well as with means to prevent ignition from the outside is described below with the aid of the drawings. These show:

- Fig. 1 a top view of the lead accumulator with the top plate of the cover removed;
- Fig. 2 a top view of the lead accumulator in Fig. 1, but with the top plate mounted;
- Fig. 3 a section along the line III-III in Fig. 2;
- Fig. 4 a section along the line IV-IV in Fig. 1 through a gas release channel;
- Fig. 5 a section along the line V-V in Fig. 1 through an ignition prevention means;
- Fig. 6 a section along the line VI-VI in Fig. 2 through a filling and service opening sealed by means of a sealing plug.

The lead accumulator consists of a plastic housing 1 in which a total of six cells are arranged in two rows. The cell voltage is carried away via two terminals 2.

The open-topped housing 1 is closed off by a cover 3 also made of thermoplastic material. This cover 3 is here composed of a base cover 4 as well as a top plate 5. As the sectional drawing according to Fig. 3 shows, the base cover 4 of the cover 1 comprises a trough-like recess 6 which is closed off on the upper side by the top plate 5 in such a way that the top plate 5 lies flush with the upper side of the base cover 4. Between the base cover 4 and the top plate 5 of the cover 3 is defined a cavity 7 for acid precipitation as well as for gas release from the lead accumulator. The cover 3 is mounted on the housing 1 by the fact that the base cover 4 of the cover 3 comprises on the lower side a peripheral edge 8 which is welded to the upper edge of the housing 1.

In the base cover 4, in the region which is not covered by the top plate 5, is provided a terminal bush 9 for the terminals 2. As shown by the squared hatching in Fig. 2, the region of the terminals 2 can be protected as contact prevention means with a single-piece cap 10. The latter is designed as a push-fit component and can be moved to different positions for easier assembly of the accumulator connecting cables. This cap 10 can be locked both in the rest position and in the open end position.

Each of the six cells comprises an opening 11 formed in the base cover 4 for filling the cell or gas release and also as a return for the acid. On this opening 11 is integrally formed an indicator rod 12 which extends vertically downwards into the cell and which serves as an indication of the maximum acid level. The base cover 4 is funnel-shaped in the region of the opening 11, by the fact that all the run-off surfaces 13 have a gradient of which the lowermost point is the opening 11, so that return of condensed acid is provided as a result. Around the opening 11 is arranged an annular protecting web 14 by which the acid is retained in case of any short-term tilting of the accumulator, wherein only a small quantity passes into the chamber-like cavity 7 formed between the base cover 4 and

the top plate 5. Retention is further increased by the fact that ribs 15 are arranged between the base cover 4 and the top plate 5 of the cover 3.

Web-like ribs 16 extending in the longitudinal direction intercept the clamping forces which occur when the accumulator is mounted over the cover 3.

The cover 3 is equipped with an integrated gas release system. In this case in the practical example shown are provided two gas release systems operating independently of each other, corresponding to the two rows of cells. For this purpose between the two rows is provided a central partition 17 which separates the two rows gas-tightly from each other. Gas release in the two rows takes place from one cell to the next. The gas in this case flows through the openings 11, into the cavity 7 formed between the base cover 4 and the top plate 5. After passing through gas release apertures 18 between the cells, the gases flow through a labyrinth 19 into a preliminary chamber 20 of ignition prevention means 21, behind which is in turn mounted a subsequent chamber 22. The gases thus flow from the preliminary chamber 20, after passing through an aperture 23 formed in the base cover 4, into the region of the ignition prevention means 21 in the form of a flame screen through which the gases flow and at the same time pass into the subsequent chamber 22. The ignition prevention means 21 is connected in receptacles 24 to receiving edges 25 of the base cover 4. Protection against ignition from the outside is ensured by the ignition prevention means 21. Due to the fact that both the preliminary chambers 20 and the subsequent chambers 22 of the two rows in each case communicate with each other and two ignition prevention means 21 are provided, multiple safety of gas release is provided. As the flame screens of the ignition prevention means 21 are arranged obliquely, it is ensured that in case of possible saturation of the flame screen the isolated particles flow onto the bottom 26 of the preliminary chamber 20 and further via the run-off

surfaces 13 and the openings 11 back into the cells. As the pore openings of the flame screen do not clog up, gas release is further ensured.

Out of the subsequent chamber 22 of the respective row of cells, the discharge gases are then conducted through gas release openings in the form of gas release channels 27 out of the accumulator. These gas release channels 27 are, as the sectional drawing according to Fig. 4 shows, inclined as well as extending obliquely towards the longitudinal side wall of the housing 1. Further they are equipped with a standardised connection 28, so that the discharge gases can be conducted away in a controlled fashion by means of hoses.

Each cell has a filling and service opening 29 which can be sealed by means of a sealing plug 30 with the interposition of a seal 31.

In the sectional drawing according to Fig. 3 can be seen the plate assemblies 32 of the individual cells. These are supported in each case by means of a support member 33. Connection of the support members 33 to the base cover 4 takes place in a recess 34 by means of correspondingly arranged ribs 35.

The accumulator shown is distinguished by an extremely flat and therefore not very high cover 3. Furthermore it has high resistance to tilting (90°) in the longitudinal direction, without the risk of uncontrolled escape of the acid. Due to the special arrangement of deflector webs 36, the ignition prevention means 21 is additionally protected against wetting with acid, and so particularly high resistance of the accumulator to tilting is achieved. The accumulator can be used preferably in commercial motor vehicles as a starter and traction battery. The accumulator is however not limited to this field of application, but can be used equally wherever accumulators with a cover 3 of low construction as well as with high tilt resistance are required.

List of reference numbers

- 1 housing
- 2 terminal
- 3 cover
- 4 base cover
- 5 top plate
- 6 trough-like recess
- 7 cavity
- 8 edge
- 9 terminal bush
- 10 cap
- 11 opening
- 12 indicator rod
- 13 run-off surface
- 14 protective web
- 15 rib
- 16 rib
- 17 partition
- 18 gas release aperture
- 19 labyrinth
- 20 preliminary chamber
- 21 ignition prevention means
- 22 subsequent chamber
- 23 aperture
- 24 receptacle
- 25 receiving edge
- 26 bottom
- 27 gas release channel
- 28 connection
- 29 filling and service opening
- 30 plug
- 31 seal
- 32 plate assembly
- 33 support member
- 34 recess
- 35 rib
- 36 deflector web

Patent claims

1. Accumulator, in particular lead accumulator, preferably for commercial motor vehicles, with a housing (1) comprising several cells as well as with a cover (3) which closes off the housing (1) and in which a labyrinthine cavity (7) for acid precipitation is formed between a lower portion and an upper portion spaced apart therefrom, wherein the lower portion of the cover (3) in the form of a base cover (4) comprises a trough-like recess (6) on top of which the upper portion of the cover is placed and connected thereto, wherein the cover (3) is further provided with a gas release opening comprising ignition prevention means (21) and comprises filling and inspection openings (2) for the cells which can in each case be sealed if occasion arises, characterised in that the upper portion of the cover (3) in the form of a top plate (5) is placed on top essentially flush with the upper side of the base cover (4) so as to form a closure and in that the depth of the trough-like recess (6) is greater than the height of an edge (8) of the base cover (4) which extends around the lower side and by means of which the base cover is mounted on the housing (3).

2. Accumulator according to claim 1, characterised in that in the trough-like recess (6) as well as on the lower side of the top plate (5) are integrally formed ribs (15, 16) which mate with each other and which on the one hand define the labyrinth and on the other hand form a mutual support for stabilising the cover (3).

3. Accumulator according to claim 1 or 2, characterised in that the terminal bushes (9) of the accumulator are located in a region of the cover (3) which is not covered by the top plate (5).

4. Accumulator according to any of claims 1 to 3, character-

ised in that in the regions of the individual cells the bottom of the trough-like recess (6) is in each case funnel-shaped in the whole cell region towards a cell opening (11) for filling or gas release and also as a return for the acid.

5. Accumulator according to any of claims 1 to 4, characterised in that on the lower side of the base cover (4) are integrally formed support members (33) which rest on the plate assembly (32) of the respective cell and support it.

6. Accumulator according to any of claims 1 to 5, characterised in that the cells are arranged in several, preferably two rows which are separated from each other by a partition (17) arranged therebetween, at the end of which are located one or more common gas release openings (27) with ignition prevention means (21).

7. Accumulator according to claim 6, characterised in that the plate assemblies (32) are arranged one behind the other in the cells of the respective row.

8. Accumulator according to claim 6 or 7, characterised in that the ignition prevention means (21) comprises a preliminary chamber (20) as well as a subsequent chamber (22).

9. Accumulator according to any of claims 6 to 8, characterised in that adjoining the ignition prevention means (21) in the base cover (4) of the cover (3) is formed a gas release channel (27).

10. Accumulator according to claim 9, characterised in that a gas release hose can be connected to the gas release channel (27) for disposal of the gas.

11. Accumulator according to claim 9 or 10, characterised in that the gas release channel (27) is inclined.

12. Accumulator according to any of claims 9 to 11, characterised in that the gas release channel (27) in relation to the longitudinal extent of the row extends obliquely towards the side wall of the housing (1).

13. Accumulator according to any of claims 9 to 12, characterised in that the gas release channels (27) associated with the rows communicate with each other and form a redundant system.

14. Accumulator according to any of claims 6 to 13, characterised in that the ignition prevention means (21) is an obliquely arranged flame screen.

15. Accumulator according to claims 1 to 14, characterised in that one or more valves forming a redundant system are used in the gas release system.